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TOWARDS LONG-RUN INTEGRATION BETWEEN FIRM-SPECIFIC AND MACROECONOMIC VARIABLES IN PAKISTAN, CHINA, AND INDIA

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ABSTRACT

The security price movements are closely related to the economic activity level. According to the Efficient Market Hypothesis (EMH), an efficient capital market is one in which stock prices change rapidly as new information becomes available. Several studies have found a relationship between changes in the economic world and macroeconomic variables. Moreover, previous studies also provide evidence of a significant relationship between firm-specific variables and stock prices. Therefore, this study was conducted to test the long-run and short-run relationship between firm-specific & macroeconomic indicators and stock prices for Pakistan, China, and India. The selected firm-specific and macroeconomic variables including Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M_2, Taxes paid by firms, and Stock Prices. Quarterly data from 2000Q1 to 2016Q4 of firm-specific and macroeconomic variables of Pakistan, China, and India was used in this study. Moreover, quarterly data of firm-specific variables were collected from Data Stream (data source of Thomson Reuters) and quarterly data of macroeconomic variables were collected from the website of IMF. Panel Cointegration tests including Kao Residual Cointegration Test andthe Augmented Dickey-Fuller Test were employed. Vector Error Correction Model (VECM) and Vector Autoregressive (VAR) Models were also employed after implication of Cointegration tests. The present study finds that there is a long-run relationship among variables (Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M_2, Taxes paid by firms, and Stock Prices) in the case of Pakistan and China; therefore, VECM was employed on data of Pakistan and China. However, in the case of India, the present study is unable to confirm a long-run relationship among variables; therefore Vector Autoregressive (VAR) was employed. The Co-integration test is also applied for data on all three countries including Pakistan, China, and India. In the present study, Vector Error Correction Model (VECM) is applied to test redundancy of variables for China and Pakistan while VAR is applied in the case of India. The ordinary least squares (OLS) method is used for estimating the unknown parameters in a linear regression model, to minimize the sum of the squares of the differences between the observed responses in the given dataset and those predicted by a linear function of a set of explanatory variables.

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KEYWORDS

Total Assets; Inflation; Exchange Rate; Interest Rate; National outcome (IPI); Money Supply M2; Taxes paid by firms; Stock Prices; Cointegration; VAR; VECM; OLS

1. INTRODUCTION

In the modern economy, the stock market plays a very significant role in the development of the economy. The study and analysis of the exchange rate can be very useful to diversify domestic funds and channels into productive investment. Nevertheless, the significant association between the stock market and macroeconomic variables is compulsory to increase productive investment.

The prosperity of an economy is linked with the efficiency of the capital market. After globalization, rapid progress was observed in capital markets at international levels. These amalgamations of markets help economies to mitigate risks, prevent financial crises, and affect the markets positively. The efficient market hypothesis suggests relevant and necessary information to investors for profit maximization, and the possibility of supernormal profit earning is fallen by the macroeconomic variables. Macroeconomic variables current position is reflecting from the stock prices(Chatrath, Ramchander, & Song, 1997).Investment advisers and portfolio managers cannot help the investors to earn supernormal profit continually because macroeconomic factors can affect stock return positively or negatively.

Country-specific macroeconomic variables and firm-specific variables also cause change momentum returns. Chen, Roll, and Ross (1986) introduce macroeconomic variables as common risk factors, and Chordia and Shivakumar (2002b) uses them to predict stock returns which in turn explain momentum returns. Habib-Ur-Rahman and Mohsin (2012)conclude that momentum in the stock market is significant but this significance is very low. Shafiai (2013)derived that momentum strategy help to forecast future stock returns based on past prices of stocks. They also found that macroeconomic variables are potential determinants of momentum return show a significant effect. Moreover, It is found that macro-economic risk variables can explain momentum (Sarwar & Muradoglu, 2013).

Chordia and Shivakumar (2002a)studied the causal relationship between macroeconomic variables and stock returns to predict momentum returns. They reported that their macroeconomic variables showed influenced the stock returns and also macroeconomic variables explained momentum returns in stock markets.

Previous studies showed the association between macroeconomic variables. Moreover, macroeconomic factors as industrial production index, inflation, interest rates,money supply, and GDP are mostly used in previous studies (Agrawalla & Tuteja, 2007; Binswanger, 2000; Das Gupta & Chandra Padhan, 2007; Laopodis, 2007; Munira, Muradoglu, & Hwang, 2008). Unfortunately, in these studies, there is a lack of selection criteria for macroeconomic variables in relationship with the stock market.

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Many studies analyze the relationship between macroeconomic variables and stock returns or momentum returns and most previous studies examining the effect of macroeconomic variables on the stock market found significant relationship between macroeconomic variables and stock returns (Abdullah & Hayworth, 1993; Bhar & Malliaris, 2014; Bulmash & Trivoli, 1991; Campbell & Shiller, 1986; Chaudhuri & Smiles, 2004; Chen et al., 1986; Cheung & Ng, 1998; Darrat, 1990a, 1990b; Dhakal, Kandil, & Sharma, 1993; Fama, 1981, 1990; Fama & French, 1996; Hsing, 2014; Humpe & Macmillan, 2009; Kim, 2003; Pilinkus, 2010, 2015; Pilinkus & Boguslauskas, 2015; Ratanapakorn & Sharma, 2007; Tsoukalas, 2003). Moreover, variables considered by these studies include real GDP, interest rates, exchange rates, inflation rates, money supply, foreign stock market indexes, etc. Their findings suggest that stock returns are influenced significantly by most of the macroeconomic variables used in these studies. Furthermore, empirical studies show a short-run and a long-run association between stock returns and macroeconomic variables (Chittedi, 2015; Dimic, Kiviaho, Piljak, & Äijö, 2016).

The main objective of this paper is to make some contribution in literature for the association between macroeconomic variables and stock prices. Furthermore, this study provides evidence after analysis that variables such as Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M_2, Taxes paid by firms, which have been found to have a great influence on stock returns in literature, are cointegrated and have causality with the price levels of Stocks.

2. LITERATURE

The forecast of future stock prices and capital market efficiency has been considered as the most thought-provoking and widely debated areas of finance. The traditional financial theory posed that financial markets are efficient. This means that all recently available information is adjusted in the prices of financial instruments. These views got popular after the efficient market hypothesis (Fama, 1970). Many psychologists, economists, and journalists are of the view that the general tendency of individuals is to overreact to the information.

Nishat and Irfan (2004)conducted a study to test the long-term relationship between stock prices and macroeconomic factors. Furthermore, the researcher used foreign exchange rate, CPI, IPI, and money supply as the explanatory variable. He used 30 years of data from 1974 to 2004. Time series data mostly contains stationarity issues,therefore;a unit root test was employed to make data stationery. They found a causal relationship between before mentioned macroeconomic variables and stock prices.The study also found that IPI shows a significant impact on all observed macroeconomic variables.

Ahmed (2008)conducted a study on prices of the SENSEX index and tested the real sector and financial sector performance on the Indian economy. Data were collected for the period of 11 years that is from 1997 to 2007. The study investigated the association between foreign direct investment, foreign exchange rate, and variables of trade. Moreover, to check the causal relationship between variables, the Granger causalitytest was employed in that study to test the causal relationship between dependent and independent variables and found Granger cause to stock prices in all independent variables. Moreover, the Auto-Regressive Model was also employed to test the speculation in the market and results were highly significant.

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Amin, Shafique, Mahmood, Ali, and Nadeem (2008)conducted a study to test the causal relationship between economic growth and stock prices. They collected data of Pakistan from1971 to 2006. They employed DF-GLS to test the causal relationship between variables. They found a highly significant association between before mentioned variables in Pakistan. Laurens and De La Piedra (1998)investigated the relationship between fiscal policy and monetary policy variables in Pakistan. The main purpose of that study was to check the role of fiscal and monetary policies in the equity market of Pakistan and found significant results. The study concluded that monetary and fiscal policies shows significant impact on market capitalization. The study further found that liquidity and equity may affect stock prices and market capitalization in case of Pakistan.

Shahbaz, Islam, and Rehman (2016)examined the relationship between the rate of inflation and stock prices using the ARDL factor analysis approach. The data was collected for the year 1971 to 2006. As a result of this investigation, it has been found that stock hedges continue for a long time, are not earmarked for further short-term expansion, and that the shadow economy affects the long-term and short-term stock prices. The survey used a sample CPI (inflation) and suggestions for the black economy.

Muhammad, Hussain, Ali, and Jalil (2009)used the Granger causality test to characterize the relationship between stock prices and selected factors using venture, GDP, and stock prices. If two lags of all factors are found, it has a very significant impact on stock prices. Gay Jr (2008)used crude oil prices and conversion standards to assess the relationship between stock costs and macroeconomic factors in China, India, Brazil, and Russia, estimated by developing countries around the world. They finally suggested that regional components of developing countries are more influential than external variables i.e.oil prices and exchange rate.

Sharma and Singh (2007), along with AR and MA, used the effects of non-stationary factors, using interest rate, industrial production index, monetary growth and inflation, and exchange rate and reserve. They found that lag values are significantly related to the share prices that define the speculations in the observed market. Scaling and saving, and both machine production records and financial development are involved. The study used data set from 1986 to 2004. Moreover, a multivariate model was used byDimitrova (2005) to test the association among economics policy, exchange rate, and stock prices. This survey characterizes the impact of equality conditions on stock prices. The results show the ambiguous effect of the debt on the stock price(Hussain, Lal, & Mubin, 2009).

Froma macroeconmics perspective, reduction in the short-term interest rate plays an impetus role to the market, gesturing insecurity about the future (Bernanke & Reinhart, 2004; Rigobon & Sack, 2001). Moreover, tendencies of momentum portfolios' to analyze the great value that reduces in durations of financial crises. On observing a rise in the lagged monthly standard of riskless interest rate, the investors invest in momentum portfolios condition. The relative importance of momentum was discussed as the factor of capital asset pricing model (CAPM) byMisra and Mohapatra (2015) discussed the relative importance of momentum as a factor of capital asset pricing model (CAPM), and discovered an inverse relationship betweencorporate spread and momentum returns.

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Association between these factors is perplexing and every factor (import,GDP, exports, FDI,and labor) has a plausible theoretical foundation to influence other factors. Imports, think about the possibility of Mundellafter which the Stock market would be specifically influenced by them - all the more, confining imports alternative influences financial specialists' universal extension. Moreover, "FDI substituting imports" was one of only a few theories on the flow of these universal capital exchanges. Other theories consider, on the contrary, the so-called "vertical integration" of international companies in the local area, leading to an inverse correlation between imports FDI (Zhang & Markusen, 1999).

3. Methodology

Investors always have to judge the allocation of their investments in different funds by buying, selling, or switching between funds. They should have a strong desire to know which economic and firm-specific factors may affect the stock market. This research may find the influence of different macroeconomic and firm-specific variables on the stock markets of Pakistan China and India. For this reason, Cointegration among observed variables is tested to check the relationship among these variables.

This study was conducted to test the long run and short-run relationship between firm-specific & macroeconomic indicators and stock prices for Pakistan, China, and India. The selected firm-specific and macroeconomic variables including Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M2, Taxes paid by firms, and Stock Prices. Quarterly data from 2000Q1 to 2016Q4 of firm-specific and macroeconomic variables of Pakistan, China, and India were used in this study. Moreover, quarterly data of firm-specific variables were collected from Data Stream (data source of Thomson Reuters) and quarterly data of macroeconomic variables were collected from the website of IMF. Panel Cointegration tests including Kao Residual Cointegration Test and Augmented Dickey-Fuller Test Equation. Vector Error Correction Model (VECM) and Vector Autoregressive (VAR) Models were also employed after Cointegration tests.

4. Empirical Results

4.1Stock returns and its determinants-Long-run relationship

In this study, we measure the long run relationship between variables included assets, inflation, exchange rate, interest rate, National outcome (IPI), money supply M2, taxes paid by firms, and prices of registered firms' stocks in Pakistan, China, and India. The co-integration method has been employed to test the relationship between variables. The assumption of stationarity of data is a mandatory requirement for the measurement of long-run relationship. In this study almost all the variables are stationary at the first difference. However, unstructured VAR was employed in the case of India because a long run relationship was not proved.

A Co-integration test is applied after confirmation of data stationarity level. Data is stationary at first differential therefore the co-integration test is applied to test the long-run relationship among variables used in the study. Total Nine variables are used in this study for this test. Variables used in this study are Assets, Inflation, Exchange Rate, Interest Rate, National

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outcome (IPI), Money Supply M2, Taxes, and Prices. Quarterly data for the period of 2001Q1 to 2015Q4 from Pakistan, India, and China is used for this estimation.

Two types of co-integration tests are applied on eight variables to confirm the long-run relationship among them. These tests are the panel co-integration test and Individual Johanson Co-integration test and these tests are performed in reviews-9. Table AP-4, AI-3, and Table AC-5 for the "Individual Johnson Co-integration Test" of Pakistan, China, and India are given in Appendices A, B & C.

4.1.1Co-integration Tests Pakistan

For measurement of LR, a cointegration test was employed in this study. However out of motivation compels me to know to the long-run relationship of macroeconomic variables, firm-specific factors, and momentum returns. The well-known test of co-integration is usually employed for the measurement of long-run relationship. Checking the stationarity of data is a pre-requisite for the estimation of the LR relationship. The null hypothesis for LR is that there is no co-integration. Rejection of the null hypothesis is an affirmation of not only co-integration but also the existence of the long-run relationship.

In the case of the Augmented dickey fuller (ADF) test, the distribution of t-statists is not the same as used in a normal t-test. The theoretical value of t is calculated through simulation in the ADF test. Therefore, the calculated value of t is compared with not the normal t but the theoretical value of t through simulation. This principle applies to all the countries considered for this county.

Co-integration tests are employed to analyze the long-run relationship of variables including assets, inflation, exchange rate, interest rate, National outcome (IPI), money supply M2, taxes paid by firms, and prices of registered firms' stocks in Pakistan. Kao (1999) presented co-integration tests in panel data as a test for the null of no co-integration. To test the null hypothesis of no co-integration, the null can be written as:

$$H_0 : \rho = 1$$

By comparing above Table AP-4a with Table AP-4b in Appendix it is shown that probability and co-efficient values for the relationship among all variables of Pakistan are 0.000 and -0.026800. The coefficient value of residual is negative as shown in Table AP-4a and Table AP-4b. Here, the Probability value rejects the null hypothesis and confirms the long-run co-integration among variables used in these models. Therefore this study concludes that long-run co-integration is shown among all variables used in this study in the case of Pakistan.

4.1.2 CO-INTEGRATION TESTS- INDIA

For Indian data, long-run co-integration among variables included assets, Inflation, exchange rate, interest rate, National outcome (IPI), money supply M2, taxes paid by firms, and prices is analyzed by using both Panel co-integration Test and Johanson Co-integration Test. Kao (1999) presented co-integration tests in panel data as a test for the null of no co-integration. To test the null hypothesis of no co-integration, the null can be written as:

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$$H_0 : \rho = 1$$

The probability value in both the Panel Co-integration test and Individual Johanson Co-integration tests is 0.1323 for Indian data. Therefore we are unable to reject the null hypothesis. The coefficient value for residual is -0.05814 as shown in Table AI-3 and Table AI4 in the appendix. Probability value 0.1323 unable to reject the null hypothesis which assures that long-run relationship is not present among variables of India used in this analysis.

4.1.3 Cointegration Test-China

Two types of co-integration tests used to analyze the long-run relationship among variables included assets, inflation, exchange rate, interest rate, National outcome (IPI), money supply M2, taxes paid by firms, and prices of registered firms' stocks in China. Kao (1999) presented co-integration tests in panel data as a test for the null of no co-integration. To test the null hypothesis of no co-integration, the null can be written as:

$$H_0 : \rho = 1$$

By comparing the above Table AC- with Table AC-5 in Appendix-C, this study finds that probability values and co-efficient values for the relationship among all variables used in these tests are 0.0127 and -0.02927 respectively. The coefficient value of residual is negative as shown in Table AC- with Table AC-5 in Appendix-C. Here, the Probability value rejects the null hypothesis and confirms the long-run co-integration among variables used in these models. Therefore present study concludes that long-run co-integration exists among all variables used in this study in the case of China.

Table 5.1: Co-integration test: Pakistan, China & India

Particulars	**Pakistan**	**China**	**India**
ADF: t-statistic	5.060379	-2.23615	1.115474
(Probability)	(0.000)	(0.0127)	(0.1323)
Residual Variance	1347.540	266320.3	385572.5
HAC Variance	1567.531	387273.0	377064.5

Detailed results of co-integration are provided in Tables AP-4, AI-4, and AC-4 for Pakistan, India & China, in appendix

4.2Country-wise analysis of VECM

The long-run relationship among variables (Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M2, Taxes paid by firms and Prices) is confirmed through Panel co-integration test and Johanson Co-integration tests.

The coefficient of adjustment measures the rate at which errors in the short run are corrected for the long-run relationship. In a multivariable model, the error model becomes VECM for the estimation of long-run relationship. Before the application of VECM, all of its pre-requisite tests are applied. The Co-integration test is applied before moving towards VECM. Another

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reason to use VECM is that time series is not stationary at their level but at their differences. Lag form of the dependent variable on the right-hand side of the equations () is used as a reference as to the test of a long-run relationship. If the coefficient of this lagged form of the dependent variable is negative and significant, there is a log run relation through error-correction.

4.2.1 Vector Error Correction Model- Pakistan

The long-run relationship among variables (Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M2, Taxes paid by firms and Prices) is confirmed through Panel co-integration test and Johanson Co-integration tests for Pakistan.

4.2.2 OLS under VECM – Pakistan

The estimation of unknown parameters in a linear regression model is done by using the Ordinary Least Squares (OLS) method. Table AP-6 in "Appendix-A" is showing the probability values of all parameters. Checking for redundancy of parameters or variables with insignificant values is necessary. For insignificant values, see OLS Table AP-6 in "Appendix-A".

4.2.3 Wald Test- Pakistan

Wald test is a redundant variable test. After having estimated VECM, the significant relationships are explained as usual. However, a redundant variable test is employed for the insignificant variable. When a variable is insignificant it creates doubt as to if a variable is redundant for the model.

The Wald test is used to test the redundancy of a subset of coefficients with insignificant probability values. These variables are showing insignificant values in OLS estimation. To confirm the redundancy of insignificant variables Wald test is applied to check the null hypothesis in this study. Null and alternative hypotheses for the Wald test are given below.

The hypothesis of the Wald test is that the variable is redundant if it is insignificant. According to these guidelines, when a hypo is rejected following the chi-square distribution, the variable is not considered redundant. Rather it is significantly important for the model.

Table AP-7 in Appendix-A is referred for a summary of the variable-wise Wald test. The main purpose of the Wald test is to check the redundancy of insignificant variables. Although, redundancy of insignificant variables is identified through this test, however, redundant variables are not excluded from model estimation because they are important as endogenous variables.

Wald test is applied on 66 insignificant restrictions or variables that are insignificant in OLS estimation as shown in Table AP-6 (See Appendix-A). A summary of each Wald test is provided in Table AP-7 in Appendix-A. This table included the results of 66 Wald tests.

4.2.4 Equation-wise Wald test

Total eight variables are used in this analysis and we find eight equations/ systems by VECM as shown in Appendix-A. Only insignificant variables from equations are used in the equation-

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wise Wald-test. Insignificant variables from only one equation in which price is used as output are explained here remaining Tables are in Appendix-A.

Table 5.2 Price as Dependent Variable, Pakistan

Wald test here is employed to test the joint significance of a subset of coefficients of equation, as shown in above Table. These variables (Assets (-1), D(Assets(-1)), D(Assets(-2)), D(Inflation(-1)), D(Inflation(-2)), D(Interest(-1)), D(Interest(-2)), D(IPI(-1)), D(exchange rate(-1)), D(exchange rate(-2)), D(M2(-1)), D(tax(-1)), D(tax(-2)), C144) are individually insignificant based on OLS test with very high p values and can be dropped as shown in Table 5.13. We want to test their joint significance using Wald test. For this purpose null hypothesis and alternative hypothesis are constructed as follows:

H0: Variables used for the estimation are redundant.

H1: Variables used in this estimation are not redundant.

The Wald test is applied to test the null hypothesis and to check whether variables used in this model are together significantly. The probability value for the relationship among endogenous variables is 0.0156 as shown in Table 5.13. Probability value confirms the significant relationship among endogenous variables in this estimation, so we are rejecting the null hypothesis. This study concludes that endogenous variables used in this estimation are not redundant. Therefore, alternative hypothesis is accepted.

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Wald Test:
System: olsvecm

Test Statistic	Value	df	Probability
Chi-square	27.68805	14	0.0156

Null Hypothesis: Assets (-1)=0, D(Assets(-1))=0, D(Assets(-2))=0, D(Inflation(-1))=0, D(Inflation(-2))=0, D(Interest(-1))=0, D(Interest(-2))=0, D(IPI(-1))=0, D(exchangerate(-1))=0, D(exchangerate(-2))=0, D(M_2(-1))=0, D(tax(-1))=0, D(tax(-2))=0, C(144)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Assets (-1)	7.28E-09	4.67E-08
D(Assets(-1))	0.000141	0.000330
D(Assets(-2))	-0.000196	0.000333
D(Inflation(-1))	0.009280	0.014659
D(Inflation(-2))	-0.006667	0.014297
D(Interest(-1))	0.019715	0.019062
D(Interest(-2))	-0.032585	0.017664
D(IPI(-1))	-0.002773	0.001639
D(exchangerate(-1))	0.003136	0.004614
D(exchangerate(-2))	-0.007033	0.004416
D(M_2(-1))	3.82E-05	5.72E-05
D(tax(-1))	-0.001590	0.005478
D(tax(-2))	-0.001860	0.005590
C(144)	-0.013184	0.035358

Restrictions are linear in coefficients.

5.18 Vector Autoregressive (VAR) Model- India

Long run co-integration is checked through Panel Co-integration and Individual Johanson Co-integration tests. Probability of both co-integration tests unable to confirm long-run relationship among variables in India. Therefore, Vector Autoregressive (VAR) Model is an appropriate test to check the speed of adjustments for long-run equilibrium in the relationship among variables. Table AI-6 for Vector Autoregressive (VAR) model is shown in Appendix-B.

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5.19 OLS under VAR - India

The estimation of unknown parameters in a linear regression model is done by using the Ordinary Least Squares (OLS) method. Table AP-6 is showing the probability values of all parameters. Checking for redundancy of parameters or variables with insignificant values is necessary. For insignificant values, see OLS Table AP-6 in Appendix.

5.20 Wald Test India

Wald test is used to test the redundancy of a subset of coefficients with an insignificant probability value. These variables are insignificant in OLS with very high p values. To confirm the redundancy of insignificant variables Wald test is applied to check the null hypothesis. Null and alternative hypotheses for the Wald test are given below.

H0: Variables used in this estimation are redundant.

H1: Variables used in this estimation are not redundant.

Table AI-9 in Appendix-B is referred for a summary of the variable-wise Wald test. The main purpose of the Wald test is to check the redundancy of insignificant variables. The redundancy of insignificant variables is identified through this test. However, redundant variables are not excluded from model estimation because they are important as endogenous variables. Wald test is applied on 49 insignificant restrictions or variables that are insignificant in Table AI-8. A summary of each Wald test is provided in Table AI-9 in Appendix-A. This table included the results of 49 Wald tests.

5.21 Wald Test India

Wald test is applied to check redundancy in data in India. Tables of Wald test and their explanation are given below:

Table 5.3: Wald Test: Price as a Dependent Variable: India

The Wald test here is used to test the joint significance of a subset of coefficients of the equation, as shown in the above Table. These variables (Assets(-1), Assets(-2), Inflation(-1), Inflation(-2), Exchange rate(-1), Exchange rate(-2), IPI(-1), IPI(-2), Price(-2), Tax(-1), Tax(-1) & C119) are individually insignificant based on OLS test with very high p values and can be dropped. We test their joint significance using the Wald test. For this purpose null hypothesis and alternative hypothesis are constructed as follows:

H0: Variables used for the estimation are redundant.

H1: Variables used in this estimation are not redundant.

The Wald test is applied to test the null hypothesis and to check whether variables used in this model are together significantly. The probability value for the relationship among endogenous variables is 0.0001. The probability value confirms the significant relationship among endogenous variables in this estimation, so we are rejecting the null hypothesis. Moreover, these results show that endogenous variables used in this estimation are not redundant. Therefore alternative hypothesis is accepted.

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Wald Test:
System: olsvarindia

Test Statistic	Value	df	Probability
Chi-square	40.47073	12	0.0001

Null Hypothesis: Assets(-1)=0, Assets(-2)=0, Inflation(-1)=0, Inflation(-2)=0, Exchange rate(-1)=0, Exchange rate(-2)=0, IPI(-1)=0, IPI(-2)=0, Price(-2)=0, Tax(-1)=0, Tax(-1)=0, C(119)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
Assets(-1)	-1.00E-05	7.07E-05
Assets(-2)	-6.53E-07	7.23E-05
Inflation(-1)	0.077851	0.040408
Inflation(-2)	-0.049375	0.038771
Exchange rate(-1)	0.338125	0.235336
Exchange rate(-2)	-0.265737	0.222937
IPI(-1)	-0.021183	0.012165
IPI(-2)	-0.012773	0.015872
Price(-2)	0.004299	0.011143
Tax(-1)	-0.005003	0.003426
Tax(-2)	0.003436	0.003523
C(119)	-0.346476	1.289386

Restrictions are linear in coefficients.

5.22 Vector Error Correction Model- China

The probability value of the co-integration test confirms a long-run relationship between variables of Chinese data. To check the speed of adjustment for long-run equilibrium in the relationship among all variables Vector Error Correction Model (VECM) is applied. The second reason to use VECM is that data is stationary at first difference.

5.23 OLS under VECM – China

The estimation of unknown parameters in a linear regression model is done by using the Ordinary Least Squares (OLS) method. Table of OLS Table AC-7 is showing the probability values of all parameters. Checking of redundancy of parameters or variables with insignificant values is necessary. For insignificant values, see OLS Table AC-7 in Appendix-C.

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5.24 Wald Test: China

Total eight variables are used in this analysis and we find eight equations/ systems by VECM as shown in Table AC-6 in an appendix. Only insignificant variables from equation no 7 are used in the equation-wise Wald-test and shown below while the remaining equation-wise tables of the Wald test are given in Appendix-C.

The above tables are showing the results of the Wald test. Variables used in this test are from equation 7 in which the dependent variable is Price as shown in Table 5.21. Only insignificant endogenous variables are used in the Wald test to check their joint significance. Endogenous variables named D(Inflation(-2)), D(Exchange rate(-2)), D(IPI(-1)), D(Tax(-1)),and D(Tax(-2)). Null and alternative hypotheses are constructed to check their redundancies are given below:

H0: Variables used in this estimation are redundant.

H1: Variables used in this estimation are not redundant.

The Wald test shows the probability value of 0.09747 which is greater than 0.05, therefore, we are unable to reject the null hypothesis. It means that endogenous variables are redundant and they do not have a significant impact on price. Summary Table of individual Wald test is in Appendix-C. I have treated VECM to check as to the existence of a possible long-run relationship. The long-run relationship is observed for the data of Pakistan and China. However, unstructured VAR has been proved more appropriate for the case of India.

Table 5.4: Wald Test, Price is dependent Variable: China

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Wald Test:
System: olsvecm

Test Statistic	Value	df	Probability
Chi-square	0.836307	5	0.9747

Null Hypothesis: D(Inflation(-2))=0, D(Exchange rate(-2))=0, D(IPI(-1))=0, D(Tax(-1))=0, D(Tax(-2))=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
D(Inflation(-2))	-0.000900	0.006612
D(Exchange rate(-2))	0.028511	0.036647
D(IPI(-1))	-0.000300	0.000862
D(Tax(-1))	2.13E-05	0.000368
D(Tax(-2))	0.000121	0.000373

Restrictions are linear in coefficients.

5. CONCLUSIONS

The Co-integration test is applied to data from 2001Q1 to 2015Q4 to check the long-term relationship among variables in cases of Pakistan, China, and India. Variables used in this study are Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M2, Taxes, and Prices. The results show that a long-term relationship among all variables exists in Pakistan and China. However, results are unable to prove long term relationship between all variables in India.

The present study finds that there is a long-run relationship among variables (Assets, Inflation, Exchange Rate, Interest Rate, National outcome (IPI), Money Supply M2, Taxes paid by firms, and Stock Prices) in the case of Pakistan and China; therefore, VECM was employed on data of Pakistan and China. However, in the case of India, the study is unable to confirm a long-run relationship among variables; therefore Vector Autoregressive (VAR) was employed. The co-integration test is also applied for data on all three countries including Pakistan, China, and India. In this study, Vector Error Correction Model (VECM) is applied to test redundancy of variables for China and Pakistan while VAR is applied in the case of India. The ordinary least squares (OLS) method is used for estimating the unknown parameters in a linear regression model, to minimize the sum of the squares of the differences

between the observed responses in the given dataset and those predicted by a linear function of a set of explanatory variables.

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